

Manufactured Landscapes

Edward Burtynsky



What do you see?

Mountains of coal for use in a coal fire power plant - China

- Coal is primarily composed of carbon. Write the balanced chemical equation for the reaction that would occur when coal burns in the air
- $\text{CO}_{2(g)} + \text{H}_2\text{O}_{(v)} \rightarrow \text{H}_2\text{CO}_{3(aq)}$
- Describe in writing what is occurring in the above reaction
- Sulphur is another element found in coal. Predict the chemical changes that sulphur will undergo first when coal is burned and next when the products of this reaction are exposed to the atmosphere. Write chemical equations to describe these reactions.

What do you want to know?

What does it make you wonder?

Mountains of coal for use in a coal fire power plant - China

- Coal is primarily composed of carbon. Write the balanced chemical equation for the reaction that would occur when coal burns in the air
- $\text{C} + \text{O}_2 \rightarrow \text{CO}_2 + \text{energy}$
- $\text{CO}_{2(\text{g})} + \text{H}_2\text{O}_{(\text{v})} \rightarrow \text{H}_2\text{CO}_{3(\text{aq})}$
- Describe in writing what is occurring in the above reaction
- Atmospheric carbon dioxide reacts with water vapour creating carbonic acid (acid rain)
- Sulphur is another element found in coal. Predict the chemical changes that sulphur will undergo first when coal is burned and next when the products of this reaction are exposed to the atmosphere. Write chemical equations to describe these reactions.
- $\text{S} + \text{O}_2 \rightarrow \text{SO}_2 + \text{energy}$
- $\text{SO}_2 + 2\text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_4 + \text{H}_2$

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What do you see?

Strip mining operation for copper – Utah, USA

What do you want to know?



Cu_2S



CuS



Cu_2O
cuprite

- To the left are two forms of sulfide ores of copper. What are their IUPAC names?
- Sulfuric acid is used to leach the copper out of oxide ores, such as cuprite, yielding a copper sulfate solution. Write a balanced chemical equation describing this process
- What type of reaction was this?

What does it make you wonder?

Strip mining operation for copper – Utah, USA



Cu_2S



CuS



Cu_2O
cuprite

- To the left are two forms of sulfide ores of copper. What are their IUPAC names?
- Copper (I) sulfide (top), and copper (II) sulfide (middle)
- Sulfuric acid is used to leach the copper out of oxide ores, such as cuprite, yielding a copper sulfate solution. Write a balanced chemical equation describing this process
- $\text{Cu}_2\text{O} + \text{H}_2\text{SO}_4 \rightarrow \text{H}_2\text{O} + \text{Cu}_2\text{SO}_4$
- What type of reaction was this?
- Double displacement

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What do you see?

Pathway through a tire dump – California, USA

What do you want to know?

- Car tires are made of a combination of natural and synthetic rubber
 - Natural rubber is made from the fined sap of rubber trees
 - Natural rubber has also been called India rubber, though today the three largest producers are Thailand, Indonesia and Malaysia
 - Car tires are black because carbon black (a fine, soft powder from the incomplete combustion of crude oil) is mixed with the rubber
 - What are the products of incomplete combustion? What effects do these products have on human health and the environment?
-
- Write a chemical equation showing incomplete combustion.
 - Why does incomplete combustion occur?

What does it make you wonder?

Pathway through a tire dump – California, USA

- Car tires are black because carbon black (a fine, soft powder from the incomplete combustion of crude oil) is mixed with the rubber
- What are the products of incomplete combustion? What effects do these products have on human health and the environment?
- CO₂ (carbon dioxide), CO (carbon monoxide), H₂O (water), C (carbon)
- Carbon dioxide is a green house gas, contributing to global warming, carbon monoxide can be deadly to human if inhaled, because it blocks oxygen from
- Write a chemical equation showing incomplete combustion.
- $\text{C}_4\text{H}_{10} + 4\text{O}_2 \rightarrow \text{CO}_2 + \text{CO} + 2\text{C} + 5\text{H}_2\text{O}$
- Why does incomplete combustion occur?
- Inadequate oxygen available

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What do you see?

Dismantling of ships – tidal flats of India

What do you want to know?

- Rust is formed when oxygen reacts with iron. Write balanced chemical equations for the production of iron (III) oxide and iron (II) oxide.
- What type of chemical reaction is this?
- What other metals can iron be mixed with to form the alloy steel and postpone rusting?
- Why are these metals effective in preventing rusting?

What does it make you wonder?

Dismantling of ships – tidal flats of India

- Rust is formed when oxygen reacts with iron. Write balanced chemical equations for the production of iron (III) oxide and iron (II) oxide.
- $4\text{Fe} + 3\text{O}_2 \rightarrow 2\text{Fe}_2\text{O}_3$
- $\text{Fe} + \text{O}_2 \rightarrow 2\text{FeO}$
- What type of chemical reaction is this?
- oxidation
- What other metals can iron be mixed with to form the alloy steel and postpone rusting?
- Zinc and aluminum
- Why are these metals effective in preventing rusting?
- The oxides produced by these metals are strong and resistant to corrosion

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What do you see?


Silver lake operations – Western Australia Gold and copper mining corporation

What do you want to know?

- Hard rock gold mining uses sodium cyanide solutions to extract gold from fine rock dust. Write a balanced chemical equation for this reaction.
- What type of chemical reaction is this?
- Based upon the metal activity series, name 3 metals that would be able to displace gold from the cyanide polyatomic?
- Write the two generic equations that can describe single displacement reactions.

What does it make you wonder?

Reference

K	Potassium		Most reactive
Na	Sodium		
Ca	Calcium		
Mg	Magnesium		
Al	Aluminium		
C	Carbon		
Zn	Zinc		
Fe	Iron		
Sn	Tin		
Pb	Lead		
H	Hydrogen		
Cu	Copper		Least reactive
Ag	Silver		
Au	Gold		
Pt	Platinum		
C	H		<i>added for comparison</i>

Reactivity Series of Metals

Silver lake operations – Western Australia Gold and copper mining corporation

- Hard rock gold mining uses sodium cyanide solutions to extract gold from fine rock dust. Write a balanced chemical equation for this reaction.
- $\text{Au} + \text{NaCN} \rightarrow \text{AuCN} + \text{Na}$
- What type of chemical reaction is this?
- Single displacement
- Based upon the metal activity series, name 3 metals that would be able to displace gold from the cyanide polyatomic?
- Silver, copper and lead (zinc is what is used in the actual precipitation reaction)
- Write the two generic equations that can describe single displacement reactions.
- $\text{AB} + \text{X} \rightarrow \text{XB} + \text{A}$
- $\text{AB} + \text{Y} \rightarrow \text{AY} + \text{B}$

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What do you see?

Tailings from a nickel mine – Sudbury, Canada

What do you want to know?

- Sulphuric acid leaching is frequently used to extract pure nickel from nickel ore. Write a balanced chemical equation that describes the reaction between this acid and the nickel in the rock.
- Lime, a component of limestone, has the chemical formula CaO . What is its IUPAC name?
- Limestone is used to treat the acidic tailings (run off from the ore piles, appear red in the picture). What type of reaction would this be?

What does it make you wonder?

Tailings from a nickel mine – Sudbury, Canada

- Sulphuric acid leaching is frequently used to extract pure nickel from nickel ore. Write a balanced chemical equation that describes the reaction between this acid and the nickel in the rock.
- $\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{H}_2 + \text{ZnSO}_4$
- Lime, a component of limestone, has the chemical formula CaO . What is its IUPAC name?
- Calcium oxide
- Limestone is used to treat the acidic tailings (run off from the ore piles, red in previous picture). What type of reaction would this be?
- $\text{CaO} + \text{H}_2\text{SO}_4 \rightarrow \text{CaSO}_4 + \text{H}_2\text{O}$, this is a neutralization reaction

- What do you see?
- What do you want to know?
- What does it make you wonder?

Answer Key and Rational 1

- Coal – combustion and synthesis
- Copper – double displacement
- Rust – oxidization
- Tires – incomplete combustion
- Gold – single displacement
- Nickel – neutralization